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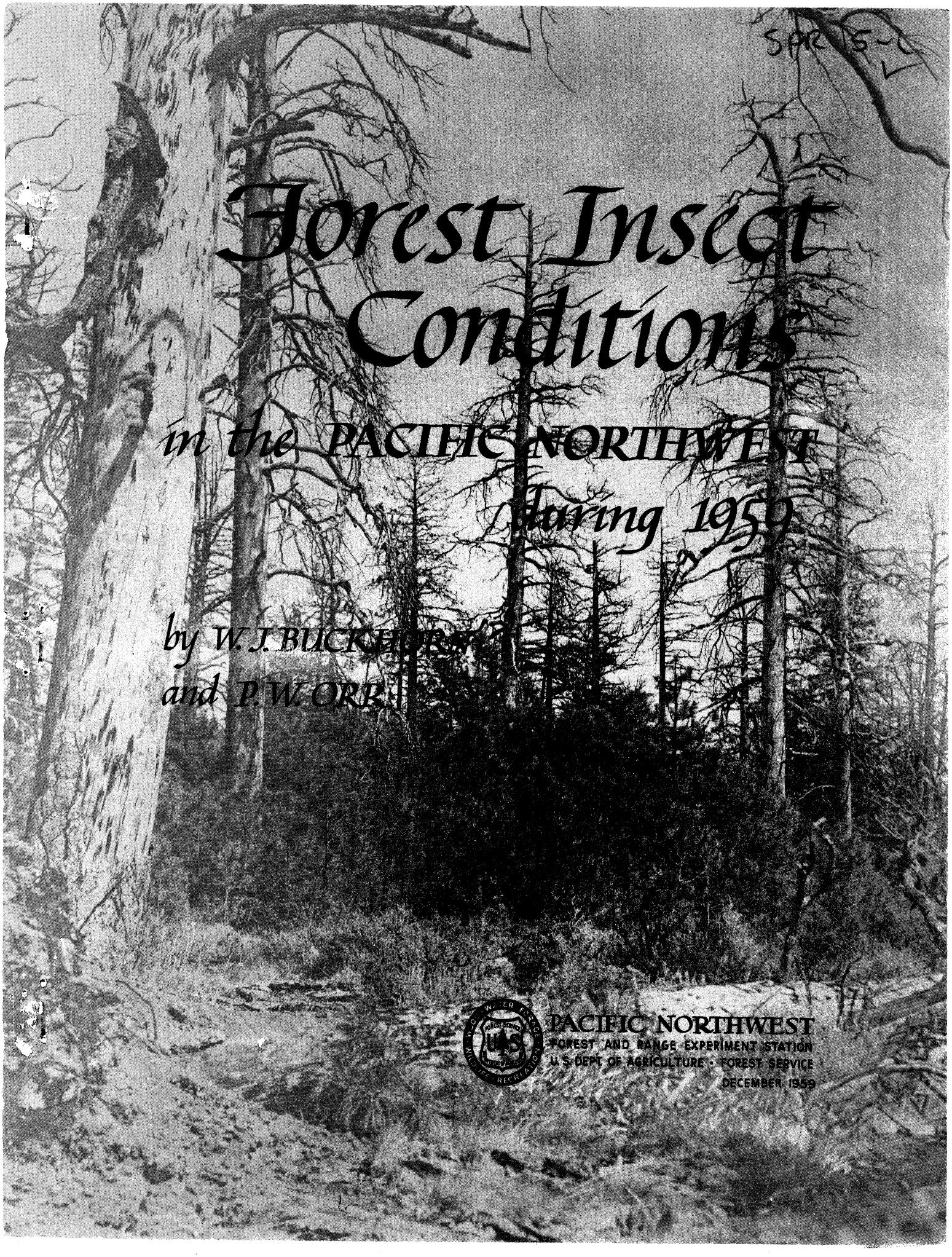

Forest Insect Conditions

in the PACIFIC NORTHWEST

during 1959

by W. J. BUCKHORN
and P. W. ORR

PACIFIC NORTHWEST
FOREST AND RANGE EXPERIMENT STATION
U. S. DEPT. OF AGRICULTURE · FOREST SERVICE
DECEMBER 1959

This is the 12th in a series of annual reports of forest insect conditions in Oregon and most of Washington, based on cooperative surveys sponsored by the Northwest Forest Pest Action Council. The combined efforts of many organizations and individuals made these surveys possible. Special acknowledgment is made to the principal cooperators: Oregon State Board of Forestry, Washington State Department of Natural Resources, and Weyerhaeuser Company.

A part of northeastern Washington is not covered in this report. Insect conditions in Lincoln, Spokane, Pend Oreille, Whitman, and parts of Ferry and Stevens Counties are reported by the Intermountain Forest and Range Experiment Station, Ogden, Utah.

COVER BACKGROUND: Mature ponderosa pines killed by the western pine beetle (Dendroctonus brevicomis Lec.).

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December 1959

PACIFIC NORTHWEST
FOREST AND RANGE EXPERIMENT STATION
R. W. Cowlin, Director Portland, Oregon

FOREST SERVICE U.S. DEPARTMENT OF AGRICULTURE

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SURVEY FINDINGS IN BRIEF

Epidemic outbreaks in the Pacific Northwest totaled 1,448,360 acres this year (table 1), next to the lowest total for the 9 years for which records are complete. The extent and intensity of outbreaks by insect species are given in the appendix in table 16 for Oregon and in table 17 for Washington. Locations of the most extensive outbreaks are shown in figure 1 in the appendix.

Principal findings of the 1959 survey were:

1. The trend of spruce budworm infestation continued downward on all areas, except the Fremont National Forest in southern Oregon, where it was strongly upward.

2. The Douglas-fir beetle outbreak in southern Oregon was considerably less severe this year and is expected to subside further in 1960. In southern Washington, the Douglas-fir beetle attacked windthrow extensively and is expected to spread to green timber next spring.

3. Tree killing by the western pine beetle was variable, increasing on some areas and decreasing on others, but becoming serious only on the Yakima Indian Reservation and adjoining areas.

4. The mountain pine beetle outbreaks flared up in young ponderosa pine in various parts of the region.

5. Tree killing by the balsam woolly aphid decreased, but the aphid populations increased considerably, indicating probable renewal of heavy killing.

6. For the first time the European pine shoot moth was discovered in the Pacific Coast States on ornamental pines in the vicinity of Seattle, Wash. It is a potential threat to ponderosa pine, should it spread to the pine region.

Chemical control was limited to small projects against bark beetles in Crater Lake National Park and on the Fremont National Forest. Sanitation-salvage logging to control the western pine beetle was increased, especially on the Ochoco National Forest. The importing of insect predators to control the balsam woolly aphid was continued and expanded for the third successive year.

Table 1.--Summary of 1959 forest insect epidemic infestations in Oregon and Washington

Insects[1/]	Oregon		Washington[2/]		Regional total	
	Infestation centers	Area	Infestation centers	Area	Infestation centers	Area
	Number	Acres	Number	Acres	Number	Acres
Defoliators:						
Spruce budworm	36	199,320	2	9,960	38	209,280
Ponderosa pine needle miner	9	16,480	0	0	9	16,480
Larch bud moth	0	0	7	4,000	7	4,000
All defoliators	45	215,800	9	13,960	54	229,760
Sucking insects:						
Balsam woolly aphid	67	50,880	30	108,480	97	159,360
Spruce aphid	26	20,960	3	5,120	29	26,080
Pine needle scale	9	6,560	2	800	11	7,360
All sucking insects	102	78,400	35	114,400	137	192,800
Bark beetles:						
Douglas-fir beetle	513	292,520	104	32,320	617	324,840
Western pine beetle	127	106,000	91	188,300	218	294,300
Mountain pine beetle (W)	129	60,000	234	153,340	363	213,340
Mountain pine beetle (L)	55	34,160	23	7,600	78	41,760
Mountain pine beetle (P)	19	4,240	15	6,080	34	10,320
Oregon pine ips	172	37,440	90	25,800	262	63,240
Fir engraver	39	15,520	48	18,640	87	34,160
Silver fir beetles	2	320	42	32,800	44	33,120
Engelmann spruce beetle	8	4,800	9	3,520	17	8,320
Douglas-fir engraver	4	2,400	0	0	4	2,400
All bark beetles	1,068	557,400	656	468,400	1,724	1,025,800
All insects	1,215	851,600	700	596,760	1,915	1,448,360

[1/] Mountain pine beetle infestations are separated by tree species: L, lodgepole pine; P, ponderosa pine; W, western white pine.

[2/] Except Lincoln, Pend Oreille, Spokane, Whitman, and parts of Ferry and Stevens Counties.

INTRODUCTION

Survey procedures were the same as in recent years. Epidemic areas were detected, evaluated, and mapped as to intensity from the air by standard methods.[1/] Infestations conspicuous enough to be mapped are listed in table 1. Ground surveys ranged from an intensive and time-consuming evaluation of the spruce budworm egg population to general checking to verify the accuracy of aerial mapping.

This year, the past practice of discussing the insects in the order of their importance based on current abundance has been discarded as no longer practical. Instead, the discussion is grouped according to the habits of the insects and the type of damage they cause. In general, the insects currently most extensively epidemic are listed first in each group. Infestation trend by species is tabulated only for the period 1956-59. The long-term trend was recorded in the 1958 report.

The principal findings of the 1959 survey were summarized in a report prepared for the annual meeting of the Northwest Forest Pest Action Council in October.[2/] The present publication gives more detailed information, including comments on insects not included in the summary report.

[1/] Wear, J. F., and Buckhorn, W. J. Organization and conduct of forest insect aerial surveys in Oregon and Washington. U.S. Forest Serv. Pac. NW. Forest and Range Expt. Sta., 40 pp., illus. (Processed.) 1955.

[2/] Buckhorn, W. J., and Orr, P. W. Important forest insect outbreaks in Oregon and Washington in 1959. 9 pp. 1959. (Unpublished report. Copy on file Pac. NW. Forest and Range Expt. Sta.)

DEFOLIATORS

SPRUCE BUDWORM
Choristoneura fumiferana (Clem.)

Outbreaks of the spruce budworm were the least extensive since records began in 1947.

Epidemic infestation continued on and adjacent to the Wallowa-Whitman and Malheur National Forests in northeastern Oregon and on the Fremont National Forest in southern Oregon. One new center of light epidemic feeding by both the spruce budworm and the black-headed budworm developed in true fir and Douglas-fir stands on the Yakima Indian Reservation and adjoining lands to the south in southern Washington (table 2).

An estimate of budworm activity in 1960 was obtained by sampling egg populations in all major infestation centers.[3/] This survey showed generally declining populations except on the Fremont National Forest, where the trend was strongly upward. Defoliation in 1960 is expected to be light except on the Fremont, where an increase in moderate and heavy feeding is expected. It is possible, however, that the increase on the Fremont may not materialize, for unusually heavy parasite and predator attacks on this year's budworm eggs may indicate increasing effectiveness of natural control. Furthermore, the history of the budworm on this area shows a series of short-lived outbreaks.

No spraying will be undertaken in 1960. If the budworm population on the Fremont continues its upward trend at its present rate, spraying may be needed in 1961. Since this outbreak extends into California, control would have to be an interstate undertaking.

3/ Carolin, V. M., and Klein, W. H. Evaluation of spruce budworm egg populations, 1959. 3 pp. 1959. (Unpublished report. Copy on file Pac. NW. Forest and Range Expt. Sta.)

Table 2.--Extent of spruce budworm infestations in Oregon and Washington in 1959, by control unit and intensity of infestation

(In acres)

Administrative area[1] and control unit	Intensity of infestation			All intensities
	Light	Moderate	Heavy	
Oregon:				
Wallowa-Whitman N.F.:				
Snake	29,920	27,680	8,160	65,760
Joseph	26,560	1,280	0	27,840
Pine Creek	15,680	4,160	0	19,840
Total	72,160	33,120	8,160	113,440
Fremont N.F.:				
Dairy Creek	28,480	20,480	0	48,960
Warner Mountains	24,160	4,000	5,280	33,440
Total	52,640	24,480	5,280	82,400
Malheur N.F.:				
Aldrich Mountain	1,440	0	0	1,440
Lookout Mountain (B.L.M.):				
Lookout Mountain	1,240	440	360	2,040
Washington:[2]				
Yakima I.R.:				
Simcoe Ridge	4,800	0	0	4,800
Glenwood District (W.S.D.N.R.):				
Simcoe Ridge	5,160	0	0	5,160
All units	137,440	58,040	13,800	209,280

[1] N.F., national forest; B.L.M., Bureau of Land Management; I.R., Indian reservation; W.S.D.N.R., Washington State Department of Natural Resources.

[2] Except Lincoln, Pend Oreille, Spokane, Whitman, and parts of Ferry and Stevens Counties.

EUROPEAN PINE SHOOT MOTH
Rhyacionia buoliana Schiff.

This European insect was reported for the first time in Pacific Coast States when it was found this spring on ornamental red pine at Bellevue, Wash. [4/] In coastal British Columbia, it has been known to occur on ornamental pines since 1927. Where it has become established in the eastern United States and Canada, it is a serious pest of plantations, nurseries, and ornamentals. It poses a threat to the ponderosa pine region, should it become established there.

Eradication is being considered. As a first step in determining the need for such action, the Northwest Forest Pest Action Council has set up a committee to deal with the problem. State inspectors in Washington already have checked numerous nurseries in the Seattle-Tacoma area and have found three to be infested. Many additional nurseries, both in Washington and in Oregon, will be inspected to determine the present distribution of the shoot moth as a basis for deciding whether eradication is practical.

PONDEROSA PINE NEEDLE MINER
Argyresthia sp.

The outbreak discovered last year on the Warner Ranger District of the Fremont National Forest (Oreg.), increased considerably in size and intensity. Trees of all ages growing on a variety of sites were infested, but open-grown saplings on dry ridges appeared most heavily attacked. Two successive years of attack did not kill or weaken any trees sufficiently to attract bark beetles.

In late September, extensive sampling on the area of greatest defoliation failed to reveal any living brood of the needle miner, which should have been present at that time of year as small larvae in the needles. The outbreak evidently has subsided naturally.

[4/] Carolin, V. M. The European pine shoot moth Rhyacionia buoliana Schiff. 4 pp. 1959. (Unpublished report. Copy on file Pac. NW. Forest and Range Expt. Sta.)

LARCH BUD MOTH
Zeiraphera griseana (Hubner)

The extent and intensity of damage to western larch in the Cascade Range decreased sharply. The principal remaining epidemic centers are on the Colville Indian Reservation and the Okanogan and Snoqualmie National Forests in Washington. In both eastern and western Oregon, this insect was found in subepidemic numbers on Douglas-fir at a number of spruce budworm research plots.

Outbreaks of the larch bud moth generally subside quickly, causing no appreciable damage; hence no special effort is made to evaluate population trends. On the spruce budworm plots, the bud moth trend on Douglas-fir was strongly downward.

BLACK-HEADED BUDWORM
Acleris variana (Fern.)

In the Cascade Range in Washington, no sign of the 1957-58 outbreak remained. On the Yakima Indian Reservation and adjoining lands to the south, the black-headed budworm and the spruce budworm teamed to cause light epidemic damage on some 9,960 acres of white fir and Douglas-fir. In eastern Oregon, subepidemic populations on grand fir appeared to have increased slightly.

Over the years, recurrent outbreaks of the black-headed budworm in Oregon and Washington characteristically have developed and subsided rapidly without causing severe damage. Since the infestation cycle is at one of its low points in stands susceptible to severe injury, no detailed evaluation of trend was made this year.

SPRUCE BUD MOTH
Zeiraphera ratzeburgiana Sax.

Spruce bud moth populations on Sitka spruce were subepidemic following last year's decline. Because of the minor importance of this insect, no attempt was made to forecast population trends.

PANDORA MOTH
Coloradia pandora Blake

A subepidemic infestation on ponderosa pine west of Sisters, Oreg., was found in 1958. Since its discovery, the outbreak has declined steadily due to animal predators, insect parasites, and probably diseases. The defoliation caused during this flareup has not been visible from the air; hence the infestation has not been classed as epidemic.

DOUGLAS-FIR TUSSOCK MOTH
Hemerocampa pseudotsugata McD.

Tussock moth cocoons were more abundant, but populations were still subepidemic, on Douglas-fir and white fir foliage examined during the spruce budworm egg survey in eastern Oregon. Although general observations indicate a slight increase in 1960, no epidemic is forecast.

WESTERN OAK LOOPER
Lambdina fiscellaria somniaria (Hulst)

Outbreaks of the oak looper in the Willamette Valley of Oregon, reported last year, collapsed without causing measurable damage to infested trees.

FALL WEBWORM
Hyphantria cunea (Drury)

This fall, the tents of the fall webworm became conspicuous on a variety of deciduous forest trees west of the Cascade Range in both States. In urban and rural areas the webworm was also quite abundant on fruit, ornamental, and shade trees. Some parasitism of full-grown larvae was noted; but since the webworm passes the winter in the pupal stage, the full impact of insect parasitism and its effect on the population level will not be known until next spring.

WESTERN TENT CATERPILLAR
Malacosoma pluviale (Dyar)

Tent caterpillars were fairly numerous on red alder in western Oregon and Washington, but caused less defoliation than during the last two seasons. The populations apparently are declining.

SAWFLIES
Neodiprion spp.

An outbreak of an unidentified species of Neodiprion on Douglas-fir on a small area southeast of Puyallup, Wash., reappeared after having subsided for 1 year, but damage was too light to map from the air. The significance of this outbreak is that it indicates the potential importance of Neodiprion as a pest on Christmas tree growing areas around Puget Sound. The outbreak is expected to subside soon because the larvae were heavily infected by a fungus disease this year.

Subepidemic sawfly populations caused some minor defoliation of subalpine fir, grand fir, and western hemlock in the Cascade Range in both States.

FIR LEAF ROLLER
Argyrotaenia dorsalana (Dyar)

In eastern Oregon, subepidemic feeding increased on true firs in areas sprayed for the spruce budworm in 1958. The resultant defoliation was not severe enough to be seen from the air.

SPRUCE NEEDLE MINER
Recurvaria sp.

Conspicuous but subepidemic feeding was recorded on the Heppner Ranger District of the Umatilla National Forest in Oregon. A temporary upward trend apparently is developing locally.

WESTERN WILLOW LEAF BEETLE
Galerucella decora Say

Extensive defoliation of various species of willows occurred in Clatsop and Tillamook Counties in northwestern Oregon.

SUCKING INSECTS

BALSAM WOOLLY APHID
Chermes piceae (Ratz.)

The area of epidemic infestation by the woolly aphid decreased for the second consecutive year (table 3). Heaviest killing by this insect occurred on and near the Gifford Pinchot National Forest in Washington and the Willamette National Forest in Oregon (table 4). Greatest damage to Pacific silver fir stands was in the Green, Toutle, and Kalama River drainages in Washington and on the Siuslaw National Forest near Black Rock in Oregon. Late in September, considerable new killing of subalpine fir became evident on the Willamette National Forest. In the Lewis River drainage in southern Washington, where killing of silver fir declined several years ago and where the aphid is currently inactive, the damaged stands are much improved.

Aphid populations continued to increase, but in spotty fashion. Most conspicuous activity was on the areas of heaviest current killing of Pacific silver fir and subalpine fir, and on grand fir in the Willamette Valley. Also of note were increased populations on subalpine fir on the Deschutes National Forest that survived earlier attack.

One new center of infestation was discovered on subalpine fir on the Yakima Indian Reservation, marking the easternmost point the aphid has been found in Washington. Extensive checking of apparently susceptible stands of Pacific silver fir north of Mount St. Helens in the Washington Cascades failed to reveal any spread in that direction, despite the fact that the aphid is epidemic in British Columbia.

Perhaps 25 percent of the total Pacific silver fir killed at the height of the outbreak has been salvaged; most of the remainder has been lost due to deterioration. More recent killing creates a continuing salvage problem. For lack of merchantability, practically none of the killed subalpine fir has been salvaged. The insignificant quantities of killed grand fir have created no salvage problem.

Efforts to effect biological control by colonizing foreign insect predators were continued with the release of 13 species totaling 38,445 individuals.[5/] Eight of the species had not previously been released. Four of the previously released species are established.

5/ Wright, K. H., and Mitchell, R. G. Research on the balsam woolly aphid in Oregon and Washington, 1959 season. 2 pp. 1959. (Unpublished report. Copy on file Pac. NW. Forest and Range Expt. Sta.)

Table 3.--Trend of balsam woolly aphid infestations in Oregon and Washington, 1956-59

(In acres)

Year of detection	Area of epidemic infestations		Regional total
	Oregon	Washington[1/]	
1956	152,210	203,780	355,990
1957	385,200	214,560	599,760
1958	110,560	145,760	256,320
1959	50,880	108,480	159,360

1/ Except Lincoln, Pend Oreille, Spokane, Whitman, and parts of Ferry and Stevens Counties.

Table 4.--Extent of balsam woolly aphid infestations in Oregon and Washington in 1959, by administrative area and intensity of infestation

Administrative area[1/ 2/]	Infestation centers	Intensity of infestation		All intensities
		Light	Moderate	
	Number	Acres		
Oregon:				
Willamette N.F.	53	32,960	3,200	36,160
Siuslaw N.F.	3	7,840	1,280	9,120
Mount Hood N.F.	7	3,680	0	3,680
Deschutes N.F.	4	1,920	0	1,920
Oregon areas	67	46,400	4,480	50,880
Washington:[3/]				
Gifford Pinchot N.F.	23	76,960	24,640	101,600
Snoqualmie N.F.	6	6,560	0	6,560
Yakima I.R.	1	320	0	320
Washington areas	30	83,840	24,640	108,480
All areas	97	130,240	29,120	159,360

1/ Areas include damage on all ownerships.

2/ N.F., national forest; I.R., Indian reservation.

3/ Except Lincoln, Pend Oreille, Spokane, Whitman, and parts of Ferry and Stevens Counties.

The predicted trend of the balsam woolly aphid population is upward in subalpine fir and grand fir. In Pacific silver fir stands the damage is expected to be static or slightly higher in 1960.

SPRUCE APHID
Aphis abietina Wlk.

Aphid populations increased in Sitka spruce stands, causing light and moderate defoliation on and near the Siskiyou and Siuslaw National Forests in Oregon. Less extensive outbreaks occurred in the coastal spruce type in southwestern Washington. In past years, this insect has killed extensive areas of spruce in Washington and Oregon before being brought under control by natural factors. Recent outbreaks have generally subsided quickly without causing serious damage. The trend of the current outbreak is uncertain. No control measures have been developed for use under forest conditions.

PINE NEEDLE SCALE
Phenacaspis pinifoliae (Fitch)

Epidemic outbreaks were conspicuous on ponderosa pine in the Hood River Valley in Oregon and in the lower Klickitat River drainage in Washington. Elsewhere, subepidemic infestations were more prevalent than in recent years on various species of pine, but caused no appreciable damage. For several years epidemic infestations of this scale have occurred on pine growing near orchards, presumably because of the killing of predators and parasites by spray drift from the orchards. The 1960 trend probably will depend to a considerable extent on the nature and amount of spraying. So far, this scale has not been sufficiently damaging to warrant control measures on forest areas.

BARK BEETLES

DOUGLAS-FIR BEETLE
Dendroctonus pseudotsugae Hopk.

The widespread epidemic on and near the the Siskiyou, Rogue River, Umpqua, and Siuslaw National Forests in southwestern Oregon peaked in 1958, and in 1959 declined considerably in amount of timber killed and acreage affected (table

5).[6/] Despite the decline, timber losses were substantial. Elsewhere in the region, much smaller centers of infestation occurred on the Okanogan, Wenatchee, and Umatilla National Forests and on the Colville Indian Reservation in Washington, and on the Wallowa-Whitman, Umatilla, and Willamette National Forests in Oregon (table 6).

Table 5.--Trend of Douglas-fir beetle infestations in Oregon and Washington, 1956-59

(In acres)

Year of detection	Area of epidemic infestations		Regional total
	Oregon	Washington[1/]	
1956	20,770	96,130	116,900
1957	10,880	7,520	18,400
1958	880,160	51,320	931,480
1959	292,520	32,320	324,840

[1/] Except Lincoln, Pend Oreille, Spokane, Whitman, and parts of Ferry and Stevens Counties.

High-velocity winds in November 1958 produced extensive areas of blowdown in southwestern Washington.[7/] Much of this favorable host material was heavily attacked by the Douglas-fir beetle this year and is expected to produce broods that will attack green timber in the spring of 1960. A special survey[8/] of broods in blowdown areas showed that shaded old growth and shaded second growth has the greatest brood production potential. Fewer broods are expected to emerge from exposed old growth, and even less from exposed second growth.

[6/] Orr, P. W., and Klein, W. H. Preliminary report on the 1959 Douglas-fir beetle trend on portions of the Siskiyou, Umpqua, and Rogue River National Forests. 4 pp. 1959. (Unpublished report. Copy on file Pac. NW. Forest and Range Expt. Sta.)

[7/] Orr, P. W., and Klein, W. H. Report on blowdown in Oregon and Washington during the winter of 1958-1959. 4 pp. 1959. (Unpublished report. Copy on file Pac. NW. Forest and Range Expt. Sta.)

[8/] Johnson, N. E., Orr, P. W., and Wright, K. H. Beetle hazard in windthrown Douglas-fir. Weyerhaeuser Co. Forestry Res. Notes. Res. Paper 20, 3 pp. (Processed.) 1959.

Table 6.--Extent of Douglas-fir beetle infestations in Oregon and Washington in 1959, by administrative area and intensity of infestation

Administrative area[1/ 2/]	Infestation centers	Intensity of infestation				All intensities
		Light	Moderate	Heavy	Very heavy	
	Number	Acres				
Oregon:						
Umpqua N.F.	127	62,720	32,480	4,320	160	99,680
Rogue River N.F.	82	39,120	17,120	6,400	560	63,200
Siskiyou N.F.	134	49,920	6,800	1,520	160	58,400
Siuslaw N.F.	71	33,160	6,720	1,120	0	41,000
Wallowa-Whitman N.F.	42	8,560	7,600	0	0	16,160
Umatilla N.F.	29	6,080	2,560	0	0	8,640
Willamette N.F.	9	2,000	160	0	0	2,160
Mount Hood N.F.	9	1,360	0	0	0	1,360
Ochoco N.F.	3	960	0	0	0	960
Malheur N.F.	6	800	0	0	0	800
Warm Springs I.R.	1	160	0	0	0	160
Oregon areas	513	204,840	73,440	13,360	880	292,520
Washington:[3/]						
Okanogan N.F.	28	3,840	1,040	4,640	0	9,520
Colville I.R.	28	6,800	1,280	1,280	0	9,360
Wenatchee N.F.	25	3,840	1,840	0	0	5,680
Umatilla N.F.	10	3,840	1,600	0	0	5,440
Gifford Pinchot N.F.	7	800	80	0	0	880
Yakima I.R.	3	480	0	0	0	480
Mount Baker N.F.	1	320	0	0	0	320
Snoqualmie N.F.	1	320	0	0	0	320
Spokane I.R.	1	320	0	0	0	320
Washington areas	104	20,560	5,840	5,920	0	32,320
All areas	617	225,400	79,280	19,280	880	324,840

1/ Areas include damage on lands of all ownerships.

2/ N.F., national forest; I.R., Indian reservation.

3/ Except Lincoln, Pend Oreille, Spokane, Whitman, and parts of Ferry and Stevens Counties.

On areas of declining populations in southern Oregon, very little further control benefit will be obtained from logging; hence salvage should be planned on the basis of the timber values to be recovered. Much of the blowdown in southern Washington has been logged, but large quantities still remain in the woods. Logging of the remaining down timber to the maximum extent possible before the beetles emerge next spring will help to reduce the amount of beetlekill that is expected.

WESTERN PINE BEETLE
Dendroctonus brevicomis Lec.

Total acreage of epidemic infestation of ponderosa pine by the western pine beetle increased for the third successive year (table 7). The trend was variable, increasing markedly on some areas and decreasing on others.

In Washington, tree killing on the Yakima Indian Reservation and in adjacent stands on the Gifford Pinchot National Forest increased to serious epidemic proportions. In Oregon, the principal areas of epidemic infestation were on or near the Umatilla, Malheur, Ochoco, and Deschutes National Forests and the Warm Springs Indian Reservation. On the Cache Mountain area of the Deschutes National Forest, where epidemic-scale killing of young ponderosa pine has been in progress for many years, root rot was found in practically all the beetle-attacked trees. This accounts for the failure of past control efforts on this area.

Sanitation-salvage logging increased in 1959, especially on national forests. On the Ochoco, sanitation-salvage logging reduced tree killing despite a strong tendency for the beetle to increase. A few trees were treated with ethylene dibromide spray in Crater Lake National Park. The most urgent need for control measures in 1960 will be on and adjacent to the Yakima Indian Reservation.

Table 7.--Trend of western pine beetle infestations in Oregon and Washington, 1956-59

(In acres)

Year of detection	Area of epidemic infestations		Regional total
	Oregon	Washington[1/]	
1956	13,920	2,110	16,030
1957	39,040	2,720	41,760
1958	96,640	56,080	152,720
1959	106,000	188,300	294,300

1/ Except Lincoln, Pend Oreille, Spokane, Whitman, and parts of Ferry and Stevens Counties.

MOUNTAIN PINE BEETLE
Dendroctonus monticolae Hopk.

Epidemic outbreaks covered essentially the same total amount of acreage as in 1958 (table 8). The situation by tree species follows:

Western white pine.--Although beetle activity declined on many areas in Washington, large centers of infestation remained, especially on the Gifford Pinchot National Forest. In Oregon, new outbreaks flared up (notably on the Mount Hood National Forest), causing considerable tree killing. Currently, control of the mountain pine beetle in white pine in these two States is considered uneconomical, largely because of the prevalence of blister rust.

Lodgepole pine.--Conditions varied widely in Oregon. The large infestation center in the vicinity of Wanoga Butte on the Deschutes National Forest subsided because the beetle had killed most of the trees of susceptible size. On the Fremont National Forest, the infestation continued aggressively in the Cougar Peak and Dead Horse Rim centers. Outbreaks in Wheeler Creek and Bear Creek drainages in Crater Lake National Park were held in check by direct control. Outside the Park, on the Rogue River National Forest, an outbreak is developing in the Sand Creek drainage and threatens to spread into the Park. In

Table 8.--Trend of mountain pine beetle infestations in Oregon and Washington, by host species, 1956-59[1/]

(In acres)

Year of detection	Area of epidemic infestations							
	Oregon				Washington[2/]			Regional total, all species
	W	L	P	S	W	L	P	
1956	34,680	52 420	7,440	0	130,180	28,040	0	252,760
1957	29,280	73,920	640	160	102,560	5,440	0	212,000
1958	32,160	36,640	2,560	0	190,880	5,920	0	268,160
1959	60,000	34,160	4,240	0	153,340	7,600	6,080	265,420

[1/] Host species are: W, western white pine; L, lodgepole pine; P, ponderosa pine; S, sugar pine.

[2/] Except Lincoln, Pend Oreille, Spokane, Whitman, and parts of Ferry and Stevens Counties.

Washington, infestations increased somewhat, especially in the Chiwawa River drainage on the Okanogan National Forest, where killing was severe several years ago.

Ponderosa pine.--The epidemic in stagnated, pole-sized ponderosa pine on the Fremont National Forest, Oreg., continued. This type of killing also occurred in several other parts of the region and is expected to increase in the years ahead if steps are not taken to reduce the stand competition that weakens the trees and makes them susceptible to beetle attack.

OREGON PINE IPS
Ips oregoni (Eichh.)

After being low for two consecutive years, ips infestation increased significantly in both Oregon and Washington (table 9). Fringe-type stands of ponderosa pine reproduction on the Wallowa-Whitman, Umatilla, and Malheur National Forests in Oregon and the Okanogan National Forest in Washington were most affected.

This year's large burns in ponderosa pine in Oregon are a potential hazard because ips beetles are likely to breed in the scorched trees, emerge, and kill nearby young pine. Prompt salvage of the fire-injured trees will help reduce this temporary hazard. Elsewhere, the usual measures of prevention should be sufficient to keep beetles in check.

Table 9.--Trend of Oregon pine ips infestations in Oregon and Washington, 1956-59

(In acres)

Year of detection	Area of epidemic infestations		Regional total
	Oregon	Washington[1/]	
1956	82,720	9,220	91,940
1957	26,880	1,760	28,640
1958	7,680	3,320	11,000
1959	37,440	25,800	63,240

1/ Except Lincoln, Pend Oreille, Spokane, Whitman, and parts of Ferry and Stevens Counties.

FIR ENGRAVER
Scolytus ventralis Lec.

Outbreaks were more extensive than last year (table 10) but remained relatively unimportant because most of the tree killing was in low-value stands of subalpine fir and decadent white fir. Heaviest mortality occurred on the Umatilla and Wallowa-Whitman National Forests in the Blue Mountains of eastern Oregon. In the Cascade Range in Washington, appreciable killing occurred on the Gifford Pinchot, Wenatchee, Mount Baker, and Okanogan National Forests. No practical control measures have been developed.

Table 10.--Trend of fir engraver infestations in Oregon and Washington, 1956-59

(In acres)

Year of detection	Area of epidemic infestations		Regional total
	Oregon	Washington[1/]	
1956	19,200	5,760	24,960
1957	9,920	11,360	21,280
1958	11,120	10,880	22,000
1959	15,520	18,640	34,160

1/ Except Lincoln, Pend Oreille, Spokane, Whitman, and parts of Ferry and Stevens Counties.

SILVER FIR BEETLES
Pseudohylesinus granulatus (Lec.)
Pseudohylesinus grandis Sw.

For the third consecutive year, infestation by silver fir beetles increased (table 11); however, the intensity remained in the light-epidemic category and the affected acreage was far less than that during the 1951-55 epidemic. Most of the infestation this year was on the Mount Baker National Forest, Wash., and the heaviest concentration was in the Baker River drainage. Salvage of currently infested trees is still the only known way to reduce the losses caused by these beetles.

Table 11.--Trend of silver fir beetle infestations in western Oregon and western Washington, 1956-59

(In acres)

Year of detection	Area of epidemic infestations		Regional total
	Western Oregon	Western Washington	
1956	0	0	0
1957	0	1,120	1,120
1958	0	4,720	4,720
1959	320	32,800	33,120

ENGELMANN SPRUCE BEETLE
Dendroctonus engelmanni Hopk.

Activity by this beetle continued low, essentially the same as last year (table 12). Epidemic infestations were largely confined to the Wallowa-Whitman National Forests in Oregon and the Wenatchee and Snoqualmie National Forests in Washington. Generally, the affected timber is of such limited amount and low value that control is not warranted, except possibly on one recreation area along the American River in Washington.

Table 12.--Trend of Engelmann spruce beetle infestations in Oregon and Washington, 1956-59

(In acres)

Year of detection	Area of epidemic infestations		Regional total
	Oregon	Washington[1/]	
1956	11,160	3,720	14,880
1957	24,480	7,680	32,160
1958	4,640	3,840	8,480
1959	4,800	3,520	8,320

1/ Except Lincoln, Pend Oreille, Spokane, Whitman, and parts of Ferry and Stevens Counties.

DOUGLAS-FIR ENGRAVER
Scolytus unispinosus Lec.

Severe drought during 1958 and 1959 weakened young Douglas-fir growing on marginal sites along the east side of the Mount Hood National Forest, predisposing them to attack by this beetle. During 1959, tree killing by the beetle was particularly heavy in the Ramsey Creek and Mill Creek areas. Control is not warranted in stands growing under such adverse conditions. Furthermore, outbreaks of this beetle characteristically subside rapidly due to natural causes.

SEED AND CONE INSECTS

These insects, particularly the ones that attack Douglas-fir and ponderosa pine, are increasingly important as forest regeneration programs are accelerated.

On most areas in 1959, insects did not cause serious damage to Douglas-fir seed, primarily because the unusually heavy cone crop diluted the effects of the available insects. The most prevalent insect was the Douglas-fir cone midge (Contarinia oregonensis Foote), which caused significant loss of seed on some areas. The Douglas-fir cone moth (Barbara colfaxiana Kearf.), one of the more destructive insects that attack Douglas-fir cones, caused relatively little damage.

Damage to ponderosa pine cones by cone moths was high again this year. Samples of cones from the Deschutes National Forest in Oregon showed that seed production had been greatly reduced by the ponderosa pine seed moth (Laspeyresia piperana (Kearf.)).

NURSERY AND REGENERATION INSECTS

TEN-LINED JUNE BEETLE
Polyphylla decemlineata (Say)

Although they are destructive pests of forest nurseries and plantations in some parts of the country, white grubs have not been considered important on forest trees in Oregon and Washington. This year, larvae of the ten-lined June beetle killed some 30 percent of the trees in a new plantation of Christmas trees near Olympia, Wash., where Douglas-fir, grand fir, and Scotch pine were killed by the large white grubs feeding on the roots. It has not been determined whether control is practical.

PINE RESIN MIDGE
Retinodiplosis sp.

Branch killing of ponderosa pine from attacks in 1958 by one or more species of resin midge was conspicuous this year at several widely scattered locations. One was near Mount McLoughlin on the Rogue River National Forest, Oreg., where trees of all ages were affected. Young-growth stands on the Okanogan National Forest and the Colville Indian Reservation in Washington also were infested. In plantations near Glenwood, Wash., an infestation of long standing has deformed many of the trees and retarded their growth, but has not killed any appreciable number of them. So far, no control has been considered necessary.

SITKA-SPRUCE WEEVIL
Pissodes sitchensis Hopk.

Damage to the leaders of young Sitka spruce by the spruce weevil at scattered places along the coast of Oregon and Washington was slightly greater than last year. This was determined by measurements on permanent study plots at Cascade Head Experimental Forest and in the Youngs River drainage in Oregon, and by general observations elsewhere.

RANGE INSECTS

CALIFORNIA TORTOISE-SHELL
Nymphalis californica (Bdv.)

This butterfly was epidemic in 1959 on snowbrush at widely separated localities in Oregon. Considerable defoliation of this browse plant occurred at Santiam Pass on the Deschutes and Willamette National Forests and in the Honey Creek drainage on the Fremont National Forest. Mass flights of the adults attracted much attention during late August and early September. Outbreaks of this insect are generally of short duration before being brought under control by natural factors.

GREAT BASIN TENT CATERPILLAR
Malacosoma fragilis Stretch

This insect, which periodically is destructive to bitterbrush, apparently was nonepidemic this year in Oregon and Washington.

OTHER FOREST PROBLEMS

Dying Hemlock

The recorded acreage of western hemlock dying from unknown causes increased considerably in 1959 (table 13). In Washington, stands in and adjacent to Olympic National Park and the Mount Baker, Snoqualmie, and Olympic National Forests sustained the most severe losses. In Oregon, the heaviest concentrations of damage were on the Siuslaw National Forest.

Table 13.--Trend of dying western hemlock in western Oregon and western Washington, 1956-59

(In acres)

Year of detection	Area of damage		Regional total
	Western Oregon	Western Washington	
1956	3,520	122,440	125,960
1957	640	245,760	246,400
1958	0	46,400	46,400
1959	6,240	138,880	145,120

Bear Damage

The extent of bear damage decreased sharply in Washington, but increased in Oregon. In total, the affected acreage decreased (table 14). The heaviest concentrations of damage in Oregon occurred in young stands in the northwestern part of the State and on the Willamette and Siuslaw National Forests. The principal centers of damage in Washington were on the Olympic and Gifford Pinchot National Forests.

Table 14.--Trend of bear damage in western Oregon and western Washington, 1956-59

(In acres)

Year of detection	Area of damage		Regional total
	Western Oregon	Western Washington	
1956	100,140	344,000	444,140
1957	101,920	103,040	204,960
1958	54,700	118,500	173,200
1959	102,160	17,920	120,080

APPENDIX

Organization and Conduct of Aerial Survey

As usual, the aerial phase of the regional survey was made cooperatively by four organizations: Oregon State Board of Forestry, Washington State Department of Natural Resources, Weyerhaeuser Co., and the Pacific Northwest Forest and Range Experiment Station. Flying time totaled 218.5 hours (table 15). Most of the survey flights were made between July 6 and August 7; the remainder were made in September.

Table 15.--Summary of cooperative aerial survey activities in 1959

Area covered	Timbered area surveyed	Survey time		
		Mapping	Ferrying	Total
	M acres	Hours		
Western Oregon	15,670	59.0	4.5	63.5
Eastern Oregon Cascades	6,591	21.7	1.6	23.3
Blue Mountains	6,964	28.4	3.7	32.1
Western Washington	11,774	49.0	4.4	53.4
Eastern Washington[1/]	7,148	41.3	4.9	46.2
All areas	48,147	199.4	19.1	218.5

1/ Except Lincoln, Pend Oreille, Spokane, Whitman, and parts of Ferry and Stevens Counties.

Table 16.--Extent of epidemic infestations in Oregon in 1959, by forest area, insect species, and intensity of infestation

Administrative area and insects involved[1/ 2/]	Infestation centers	Intensity of infestation				All intensities
		Light	Moderate	Heavy	Very heavy	
	Number	Acres				
Deschutes N.F. and adjacent forest lands:						
Balsam woolly aphid	4	1,920	0	0	0	1,920
Mountain pine beetle (L)	8	1,840	960	0	0	2,800
Western pine beetle	11	10,960	1,600	2,560	0	15,120
All insects	23	14,720	2,560	2,560	0	19,840
Fremont N.F. and adjacent forest lands:						
Spruce budworm	15	52,640	24,480	5,280	0	82,400
Ponderosa pine needle miner	9	8,960	6,080	1,440	0	16,480
Western pine beetle	7	3,840	0	0	0	3,840
Mountain pine beetle (L)	18	3,040	3,040	320	4,000	10,400
Mountain pine beetle (P)	15	480	2,320	640	0	3,440
Oregon pine ips	4	800	480	0	0	1,280
All insects	68	69,760	36,400	7,680	4,000	117,840

See footnotes at end of table.

Table 16.--Extent of epidemic infestations in Oregon in 1959 ... (Continued)

Administrative area and insects involved 1/ 2/	Infestation centers	Intensity of infestation				All intensities
		Light	Moderate	Heavy	Very heavy	
	Number	Acres				
Malheur N.F. and adjacent forest lands:						
Spruce budworm	2	1,440	0	0	0	1,440
Douglas-fir beetle	6	800	0	0	0	800
Western pine beetle	23	13,840	0	0	0	13,840
Mountain pine beetle (L)	3	960	320	0	0	1,280
Oregon pine ips	26	3,280	1,120	960	0	5,360
Fir engraver	1	0	160	0	0	160
All insects	61	20,320	1,600	960	0	22,880
Mt. Hood N.F. and adjacent forest lands:						
Balsam woolly aphid	7	3,680	0	0	0	3,680
Pine needle scale	9	0	1,040	160	5,360	6,560
Douglas-fir beetle	9	1,360	0	0	0	1,360
Western pine beetle	3	3,360	0	0	0	3,360
Mountain pine beetle (W)	50	11,840	13,280	3,360	0	28,480
Oregon pine ips	6	1,360	1,440	0	0	2,800
Fir engraver	5	480	320	0	0	800
Silver fir beetles	2	160	160	0	0	320
Douglas-fir engraver	4	0	0	2,400	0	2,400
All insects	95	22,240	16,240	5,920	5,360	49,760

See footnotes at end of table.

Table 16.--Extent of epidemic infestations in Oregon in 1959 ... (Continued)

Administrative area and insects involved[1/ 2/]	Infestation centers	Intensity of infestation				All intensities
		Light	Moderate	Heavy	Very heavy	
	Number	Acres				
Ochoco N.F. and adjacent forest lands:						
Douglas-fir beetle	3	960	0	0	0	960
Western pine beetle	24	23,360	4,960	0	0	28,320
Oregon pine ips	16	2,000	480	0	0	2,480
Fir engraver	1	960	0	0	0	960
All insects	44	27,280	5,440	0	0	32,720
Rogue River N.F. and adjacent forest lands:						
Douglas-fir beetle	82	39,120	17,120	6,400	560	63,200
Western pine beetle	23	5,760	320	0	0	6,080
Mountain pine beetle (L)	7	4,800	0	0	0	4,800
Oregon pine ips	3	800	0	0	0	800
All insects	115	50,480	17,440	6,400	560	74,880
Siskiyou N.F. and adjacent forest lands:						
Spruce aphid	6	4,320	960	160	0	5,440
Douglas-fir beetle	134	49,920	6,800	1,520	160	58,400
Western pine beetle	1	80	0	0	0	80
All insects	141	54,320	7,760	1,680	160	63,920

See footnotes at end of table.

Table 16.--Extent of epidemic infestations in Oregon in 1959 ... (Continued)

Administrative area and insects involved[1/ 2/]	Infestation centers	Intensity of infestation				All intensities
		Light	Moderate	Heavy	Very heavy	
	Number	Acres				
Siuslaw N.F. and adjacent forest lands:						
Balsam woolly aphid	3	7,840	1,280	0	0	9,120
Spruce aphid	16	9,760	4,160	0	0	13,920
Douglas-fir beetle	71	33,160	6,720	1,120	0	41,000
All insects	90	50,760	12,160	1,120	0	64,040
Umatilla N.F. and adjacent forest lands:						
Douglas-fir beetle	29	6,080	2,560	0	0	8,640
Western pine beetle	18	11,520	1,600	0	0	13,120
Mountain pine beetle (L)	4	480	640	0	0	1,120
Mountain pine beetle (P)	1	160	0	0	0	160
Oregon pine ips	40	3,520	2,880	1,440	0	7,840
Fir engraver	14	1,440	4,320	0	0	5,760
All insects	106	23,200	12,000	1,440	0	36,640

See footnotes at end of table.

Table 16.--Extent of epidemic infestations in Oregon in 1959 ... (Continued)

Administrative area and insects involved[1/ 2/]	Infestation centers	Intensity of infestation				All intensities
		Light	Moderate	Heavy	Very heavy	
	Number	Acres				
Umpqua N.F. and adjacent forest lands:						
Douglas-fir beetle	127	62,720	32,480	4,320	160	99,680
Western pine beetle	2	480	0	0	0	480
Mountain pine beetle (W)	3	1,120	0	480	0	1,600
Fir engraver	1	160	0	0	0	160
All insects	133	64,480	32,480	4,800	160	101,920
Wallowa-Whitman N.F. and adjacent forest lands:						
Spruce budworm	16	72,160	33,120	8,160	0	113,440
Douglas-fir beetle	42	8,560	7,600	0	0	16,160
Western pine beetle	6	2,560	0	0	0	2,560
Mountain pine beetle (L)	5	2,080	480	0	0	2,560
Mountain pine beetle (P)	2	160	0	0	320	480
Oregon pine ips	76	8,480	7,440	160	0	16,080
Fir engraver	17	3,680	1,920	2,080	0	7,680
Engelmann spruce beetle	6	160	2,080	640	0	2,880
All insects	170	97,840	52,640	11,040	320	161,840

See footnotes at end of table.

Table 16.--Extent of epidemic infestations in Oregon in 1959 ... (Continued)

Administrative area and insects involved[1/ 2/]	Infestation centers	Intensity of infestation				All intensities
		Light	Moderate	Heavy	Very heavy	
	Number	Acres				
Willamette N.F. and adjacent forest lands:						
Balsam woolly aphid	53	32,960	3,200	0	0	36,160
Douglas-fir beetle	9	2,000	160	0	0	2,160
Mountain pine beetle (W)	73	16,800	6,560	5,120	960	29,440
Mountain pine beetle (L)	2	1,120	480	0	0	1,600
Engelmann spruce beetle	2	1,920	0	0	0	1,920
All insects	139	54,800	10,400	5,120	960	71,280
Crater Lake N.P.:						
Mountain pine beetle (L)	2	3,520	0	0	0	3,520
Klamath I.R.:						
Mountain pine beetle (L)	7	4,480	640	640	0	5,760
Oregon pine ips	1	0	0	800	0	800
All insects	8	4,480	640	1,440	0	6,560

See footnotes at end of table.

Table 16.--Extent of epidemic infestations in Oregon in 1959 ... (Continued)

Administrative area and insects involved[1/] [2/]	Infestation centers	Intensity of infestation				All intensities
		Light	Moderate	Heavy	Very heavy	
	Number	Acres				
Warm Springs I.R.:						
Douglas-fir beetle	1	160	0	0	0	160
Western pine beetle	9	13,600	5,600	0	0	19,200
Mountain pine beetle (L)	2	0	0	800	0	800
Mountain pine beetle (P)	1	160	0	0	0	160
All insects	13	13,920	5,600	800	0	20,320
Northwest Oregon (O.S.B.F.):						
Spruce aphid	4	960	640	0	0	1,600
Lookout Mt. (B.L.M.):						
Spruce budworm	3	1,240	440	360	0	2,040

[1/] Mountain pine beetle damage has been separated by tree species attacked: L, lodgepole pine; W, western white pine; P, ponderosa pine.

[2/] Administrative areas are abbreviated as follows: N.F., national forest; B.L.M., Bureau of Land Management; N.P., national park; I.R., Indian reservation; O.S.B.F., Oregon State Board of Forestry.

Table 17.--Extent of epidemic infestations in Washington in 1959, by forest area, insect species, and intensity of infestation[1/]

Administrative area and insects involved[2/ 3/]	Infestation centers	Intensity of infestation				All intensities
		Light	Moderate	Heavy	Very heavy	
	Number	Acres				
Gifford Pinchot N.F. and adjacent forest lands:						
Balsam woolly aphid	23	76,960	24,640	0	0	101,600
Pine needle scale	2	480	320	0	0	800
Douglas-fir beetle	7	800	80	0	0	880
Western pine beetle	6	18,720	11,200	0	0	29,920
Mountain pine beetle (W)	44	21,360	30,880	23,680	480	76,400
Fir engraver	7	3,600	1,440	640	0	5,680
All insects	89	121,920	68,560	24,320	480	215,280
Mt. Baker N.F. and adjacent forest lands:						
Douglas-fir beetle	1	320	0	0	0	320
Mountain pine beetle (W)	42	5,760	6,720	9,120	0	21,600
Fir engraver	3	0	2,720	0	0	2,720
Silver fir beetles	40	18,240	9,600	4,640	0	32,480
All insects	86	24,320	19,040	13,760	0	57,120

See footnotes at end of table.

Table 17.--Extent of epidemic infestations in Washington in 1959 ... (Continued)

Administrative area and insects involved[2/ 3/]	Infestation centers	Intensity of infestation				All intensities
		Light	Moderate	Heavy	Very heavy	
	Number	Acres				
Okanogan N.F. and adjacent forest lands:						
Larch bud moth	1	480	0	0	0	480
Douglas-fir beetle	28	3,840	1,040	4,640	0	9,520
Western pine beetle	22	5,600	960	0	0	6,560
Mountain pine beetle (P)	5	2,560	480	0	0	3,040
Mountain pine beetle (L)	4	320	0	800	0	1,120
Oregon pine ips	29	1,840	1,520	2,480	800	6,640
Fir engraver	12	1,720	320	0	0	2,040
Pine resin midge	1	0	1,440	0	0	1,440
All insects	102	16,360	5,760	7,920	800	30,840
Olympic N.F. and adjacent forest lands:						
Mountain pine beetle (W)	25	6,240	2,240	160	0	8,640
Silver fir beetles	1	160	0	0	0	160
All insects	26	6,400	2,240	160	0	8,800

See footnotes at end of table.

Table 17.--Extent of epidemic infestations in Washington in 1959 ... (Continued)

Administrative area and insects involved[2/ 3/]	Infestation centers	Intensity of infestation				All intensities
		Light	Moderate	Heavy	Very heavy	
	Number	Acres				
Snoqualmie N.F. and adjacent forest lands:						
Larch bud moth	1	0	480	0	0	480
Balsam woolly aphid	6	6,560	0	0	0	6,560
Douglas-fir beetle	1	160	0	0	0	160
Western pine beetle	8	1,280	0	0	0	1,280
Mountain pine beetle (W)	14	1,440	2,620	640	0	4,700
Fir engraver	1	160	0	0	0	160
Silver fir beetles	1	160	0	0	0	160
Engelmann spruce beetle	5	960	1,280	0	0	2,240
All insects	37	10,720	4,380	640	0	15,740
Umatilla N.F. and adjacent forest lands:						
Douglas-fir beetle	10	3,840	1,600	0	0	5,440
Mountain pine beetle (L)	1	0	640	0	0	640
Oregon pine ips	10	1,280	2,560	1,120	0	4,960
Fir engraver	10	3,200	640	960	0	4,800
All insects	31	8,320	5,440	2,080	0	15,840

See footnotes at end of table.

Table 17.--Extent of epidemic infestations in Washington in 1959 ... (Continued)

Administrative area and insects involved 2/ 3/	Infestation centers	Intensity of infestation				All intensities
		Light	Moderate	Heavy	Very heavy	
	Number	Acres				
Wenatchee N.F. and adjacent forest lands:						
Douglas-fir beetle	25	3,840	1,840	0	0	5,680
Western pine beetle	20	5,680	4,640	0	0	10,320
Mountain pine beetle (L)	12	2,880	960	0	0	3,840
Mountain pine beetle (P)	1	0	0	800	0	800
Mountain pine beetle (W)	52	4,960	7,680	4,800	0	17,440
Oregon pine ips	7	240	2,400	1,440	0	4,080
Fir engraver	13	2,960	160	0	0	3,120
Engelmann spruce beetle	4	960	320	0	0	1,280
All insects	134	21,520	18,000	7,040	0	46,560
Mt. Rainier N.P.:						
Mountain pine beetle (W)	5	320	640	0	0	960
Olympic N.P.:						
Mountain pine beetle (W)	47	9,680	5,920	800	0	16,400

See footnotes at end of table.

Table 17.--Extent of epidemic infestations in Washington in 1959 ... (Continued)

Administrative area and insects involved 2/ 3/	Infestation centers	Intensity of infestation				All intensities
		Light	Moderate	Heavy	Very heavy	
	Number	Acres				
Colville I.R.:						
Larch bud moth	5	960	2,080	0	0	3,040
Douglas-fir beetle	28	6,800	1,280	1,280	0	9,360
Western pine beetle	16	3,120	960	0	0	4,080
Mountain pine beetle (L)	5	0	960	720	0	1,680
Mountain pine beetle (P)	4	1,120	0	0	0	1,120
Oregon pine ips	17	2,320	1,200	3,360	0	6,880
All insects	75	14,320	6,480	5,360	0	26,160
Quinault I.R.:						
Mountain pine beetle (W)	4	6,560	480	0	0	7,040
Spokane I.R.:						
Douglas-fir beetle	1	320	0	0	0	320
Oregon pine ips	5	0	400	0	0	400
All insects	6	320	400	0	0	720

See footnotes at end of table.

Table 17.--Extent of epidemic infestations in Washington in 1959 ... (Continued)

Administrative area and insects involved[2/ 3/]	Infestation centers	Intensity of infestation				All intensities
		Light	Moderate	Heavy	Very heavy	
	Number	Acres				
Yakima I.R.:						
Spruce budworm	1	4,800	0	0	0	4,800
Balsam woolly aphid	1	320	0	0	0	320
Douglas-fir beetle	3	480	0	0	0	480
Western pine beetle	14	72,480	41,600	17,440	0	131,520
Mountain pine beetle (L)	1	0	320	0	0	320
Mountain pine beetle (P)	2	640	0	0	0	640
Oregon pine ips	2	0	880	0	0	880
Fir engraver	1	0	80	0	0	80
All insects	25	78,720	42,880	17,440	0	139,040
Glenwood District (W.S.D.N.R.):						
Spruce budworm	1	5,160	0	0	0	5,160
Western pine beetle	5	4,620	0	0	0	4,620
Mountain pine beetle (P)	3	480	0	0	0	480
Oregon pine ips	20	480	1,440	40	0	1,960
Fir engraver	1	0	40	0	0	40
All insects	30	10,740	1,480	40	0	12,260

See footnotes at end of table.

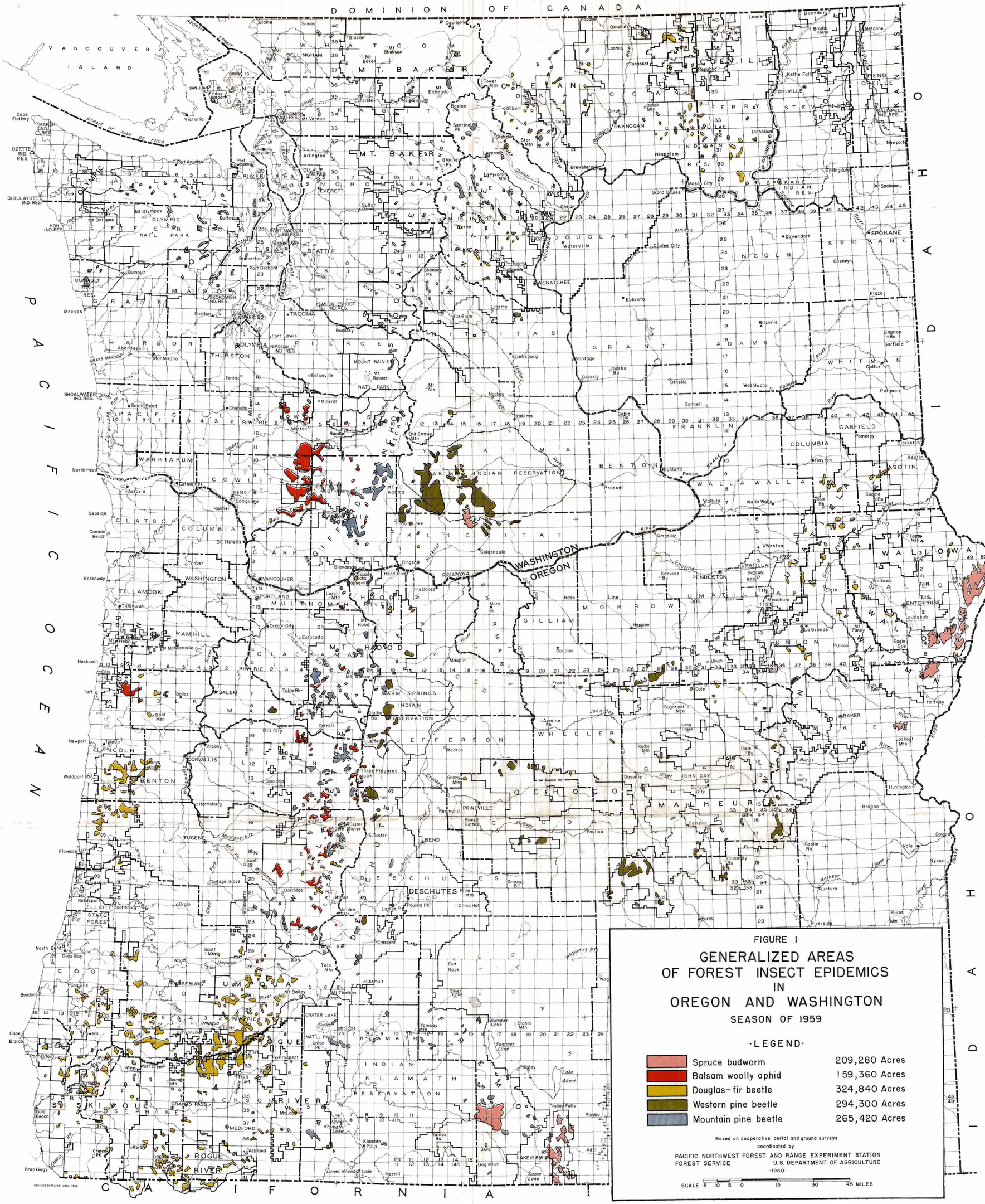
Table 17.--Extent of epidemic infestations in Washington in 1959 ... (Continued)

Administrative area and insects involved[2/ 3/]	Infestation centers	Intensity of infestation				All intensities
		Light	Moderate	Heavy	Very heavy	
	Number	Acres				
San Juan District (W.S.D.N.R.):						
Mountain pine beetle (W)	1	160	0	0	0	160
Southwest Washington (W.S.D.N.R.):						
Spruce aphid	3	2,400	2,400	320	0	5,120

1/ All of Washington except Lincoln, Pend Oreille, Spokane, Whitman, and parts of Ferry and Stevens Counties.

2/ Mountain pine beetle damage has been separated by tree species attacked: L, lodgepole pine; P, ponderosa pine; W, western white pine.

3/ Administrative areas are abbreviated as follows: N.F., national forest; I.R., Indian reservation; N.P., national park; W.S.D.N.R., Washington State Department of Natural Resources.


DOMINION OF CANADA
VANCOUVER ISLAND
STRAIT OF GEORGIA
STRAIT OF JUAN DE FUCA
PACIFIC OCEAN
IDAHO
CALIFORNIA
WASHINGTON
OREGON
BELLINGHAM
SEATTLE
TACOMA
OLYMPIA
EVERETT
VANCOUVER
PORTLAND
SALEM
EUGENE
ASTORIA
MEDFORD
KLAMATH FALLS
LAKEVIEW
PENDLETON
BAKER
LA GRANDE
WALLA WALLA
YAKIMA
WENATCHEE
SPOKANE
COLVILLE
PRINEVILLE
BEND
ROSEBURG
GRANTS PASS
COOS BAY
NORTH BEND
TILLAMOOK
NEWPORT
CORVALLIS
ALBANY
MT. BAKER
OLYMPIC NAT'L PARK
MOUNT RAINIER NAT'L PARK
CRATER LAKE NAT'L PARK
COLUMBIA RIVER
SNAKE RIVER
YAKIMA INDIAN RESERVATION
WARM SPRINGS INDIAN RESERVATION
KLAMATH INDIAN RESERVATION
UMATILLA INDIAN RES.
COLVILLE INDIAN RES.
SPOKANE INDIAN RES.
FIGURE 1
GENERALIZED AREAS
OF FOREST INSECT EPIDEMICS
IN
OREGON AND WASHINGTON
SEASON OF 1959
·LEGEND·
Spruce budworm 209,280 Acres
Balsam woolly aphid 159,360 Acres
Douglas-fir beetle 324,840 Acres
Western pine beetle 294,300 Acres
Mountain pine beetle 265,420 Acres
Based on cooperative aerial and ground surveys
coordinated by
PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION
FOREST SERVICE U.S. DEPARTMENT OF AGRICULTURE
·1960·
SCALE 15 10 5 0 15 30 45 MILES